

Chapter 5

PROJECT IMPLEMENTATION

PROPOSED COMPREHENSIVE EVERGLADES RESTORATION PLAN (CERP) COMPONENTS AND PROJECT ELEMENTS IN NORTHERN PALM BEACH COUNTY

The overall plan for Everglades restoration was developed by the United States Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD) and approved by congress in 2000. The proposed Comprehensive Everglades Restoration Plan (CERP) components and other project elements in northern Palm Beach County are described in this section, along with their estimated costs and schedules. These projects will be implemented using a combination of federal, state, regional and local funding and support. The individual components and elements were developed based, in part, on input from earlier drafts of the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) and resemble the list of recommended projects developed by local stakeholders in this planning process. The CERP adopted the early concepts of the NPBCCWMP and subsequent modeling in the Lower East Coast Regional Water Supply Plan (LECRWSP) confirmed their validity.

The CERP includes activities that were not considered by the local stakeholders, for numerous reasons including, but not limited to, the larger regional scope and 50-year design horizon of the CERP. The inclusion by the CERP of a larger set of water management goals and options, enhances the probability that the components identified by the CERP in the selected alternative will address subregional needs of northern Palm Beach County, concurrent with other regional requirements.

As noted in the discussion of historical hydrology, the current basins in the region were previously connected at high water stages. Opportunities exist in the CERP planning process to expand the boundaries of the study area to include additional contributing watersheds. The challenge is to create operational flexibility, which allows water to be moved as needed to maximize benefits over the widest range of hydrologic conditions, and to consider environmental, agricultural and urban needs concurrently. An example of such an opportunity is the role that the J.W. Corbett Wildlife Management Area may play in the NPBCCWMP. Excess water above the management area's desired hydroperiod range can be used as a water supply source. Early thinking was that this water could be directed to Lake Okeechobee and used for Everglades restoration; however, recent analyses have indicated that it may be better to use excess water from the Corbett Area in other locations, including northern Palm Beach County.

Several CERP components were combined to create the "North Palm Beach County Project," which has two parts, as discussed below. The components were consolidated to ensure that the interdependencies were evaluated concurrently and thus

minimize conflicts among competing goals. Recent estimated costs and timeframes for components and elements of the North Palm Beach County Project are shown in **Table 3**, but these are subject to change. A project management plan (PMP) for Part 1 of the North Palm Beach County Project will be completed in early 2002 and will identify the responsibilities of the local sponsors and govern the nature of future planning activities. Following the initial planning phase, a project implementation report (PIR) will identify recommended courses of action and the roles of local sponsors in its implementation. The PIR for the North Palm Beach County Project will be complete by March 2004.

Table 3. Northern Palm Beach County Comprehensive Everglades Restoration Plan (CERP)
Components - Parts 1 and 2.*

Title	Projected Cost	Start Date	Finish Date
PART 1 - North Palm Beach County Project (X,Y,GGG, Pal-Mar, LWL, KPh1)**			
PMP Development X,Y,K Phase 1, GGG, Pal-Mar, Lake Worth Lagoon	\$300,000	04/02/2001	10/31/2001
PIR X,Y,K Phase 1,GGG, Pal-Mar, Lake Worth Lagoon	\$14,343,000	11/01/2001	03/26/2004
Pal-Mar and J.W. Corbett Wildlife Management Area Hydropattern Restoration (OPE)	\$10,447,000	03/29/2004	03/20/2009
L-8 Basin Modifications (K Phase 1)	\$17,938,000	03/29/2004	03/18/2011
C-51 & Southern L-8 Reservoir (GGG)	\$328,056,000	03/29/2004	03/14/2014
Lake Worth Lagoon Restoration (OPE)	\$2,268,000	03/29/2004	03/21/2008
C-17 Backpumping & Treatment (X)	\$19,835,000	03/29/2004	03/19/2010
C-51 Backpumping & Treatment (Y)	\$31,892,000	03/29/2004	03/19/2010
TOTAL	\$425,079,000		
PART 2 - North Palm Beach County Project (K Ph2, LL)**			
PMP Development K Phase 2, LL	\$300,000	05/01/2009	10/29/2009
PIR K Phase 2,LL	\$7,042,000	10/30/2009	04/26/2012
C-51 Regional Groundwater Aquifer Storage & Recovery (LL)	\$127,291,000	04/27/2012	10/15/2020
L-8 Basin Aquifer Storage & Recovery (K Phase 2)	\$53,428,000	04/27/2012	10/18/2018
TOTAL	\$188,061,000		

* These are estimated costs and dates and are subject to change; X, Y, GGG, K, LL etc. are CERP component codes (see text).

The North Palm Beach County Project, Part 1 includes six separable elements -- Four have corresponding letter codes and two "other project elements" (OPEs), including: (1) Pal-Mar and J.W. Corbett Wildlife Management Area Hydropattern Restoration (OPE), (2) L-8 Basin Modifications (K - Part 1), (3) C-51 and L-8 Reservoir (GGG), (4) Lake Worth Lagoon Restoration (OPE), (5) C-17 Backpumping and Treatment (X), and (6) C-51 Backpumping and Treatment (Y). These separable elements were combined into a single project to address the interdependencies and trade-offs among the different elements and provide a more effective design of the overall project. Approximate locations of these projects are shown in **Figure 3**.

In conjunction with development of the PIR, authorization was given to move forward with the L-8 Reservoir Testing Project, using local and state funds for preliminary studies to determine if the proposed reservoir concept can hold water. Subsequently, when the L-8 Basin component is initiated, these funds will be credited as a matching contribution to the CERP project. The total (local and federal) cost of the testing project is not to exceed \$3,100,000.

The North Palm Beach County Project, Part 2 includes two separable elements. The C-51 Regional Groundwater Aquifer Storage and Recovery (ASR) system (LL) will provide an estimated additional long-term storage capacity of 170 million gallons per day (mgd) and the L-8 Basin ASR system (K - Part 2) will provide an estimated 50 mgd of storage capacity. These projects were separated and deferred into Part 2 (**Table 3**), to be consistent with time frames of the ASR pilot projects.

It is important to note that the PMP and PIR schedules for Part 1 of the North Palm Beach County Project reflect the local need to accelerate the federal process. In particular, the PIR schedule will enable land acquisition to begin as early as March 2004.

North Palm Beach County Project Implementation Report (PIR) - Part 1

Pal-Mar and J.W. Corbett Wildlife Management Area Hydropattern Restoration (OPE)

This separable element will consider improvements such as new or modified water control structures, canal modifications and the acquisition of 3,000 acres located between Pal-Mar and the J.W. Corbett Wildlife Management Area in Palm Beach County. The purpose of this element is to provide hydrologic connections between the J. W. Corbett Wildlife Management Area and: (1) the Moss Property, (2) the C-18 Canal, (3) the Indian Trail Improvement District (ITID), and (4) the L-8 Borrow Canal, in addition to extending the spatial extent of protected natural areas. These connections would reduce detrimental effects on native vegetation that occurred due to over inundation frequently experienced during the wet season. This element will also extend the footprint of the contiguous greenbelt to 126,000 acres, extending from the Dupuis Reserve near Lake Okeechobee across the J.W. Corbett Wildlife Management Area and south to Jonathan Dickinson State

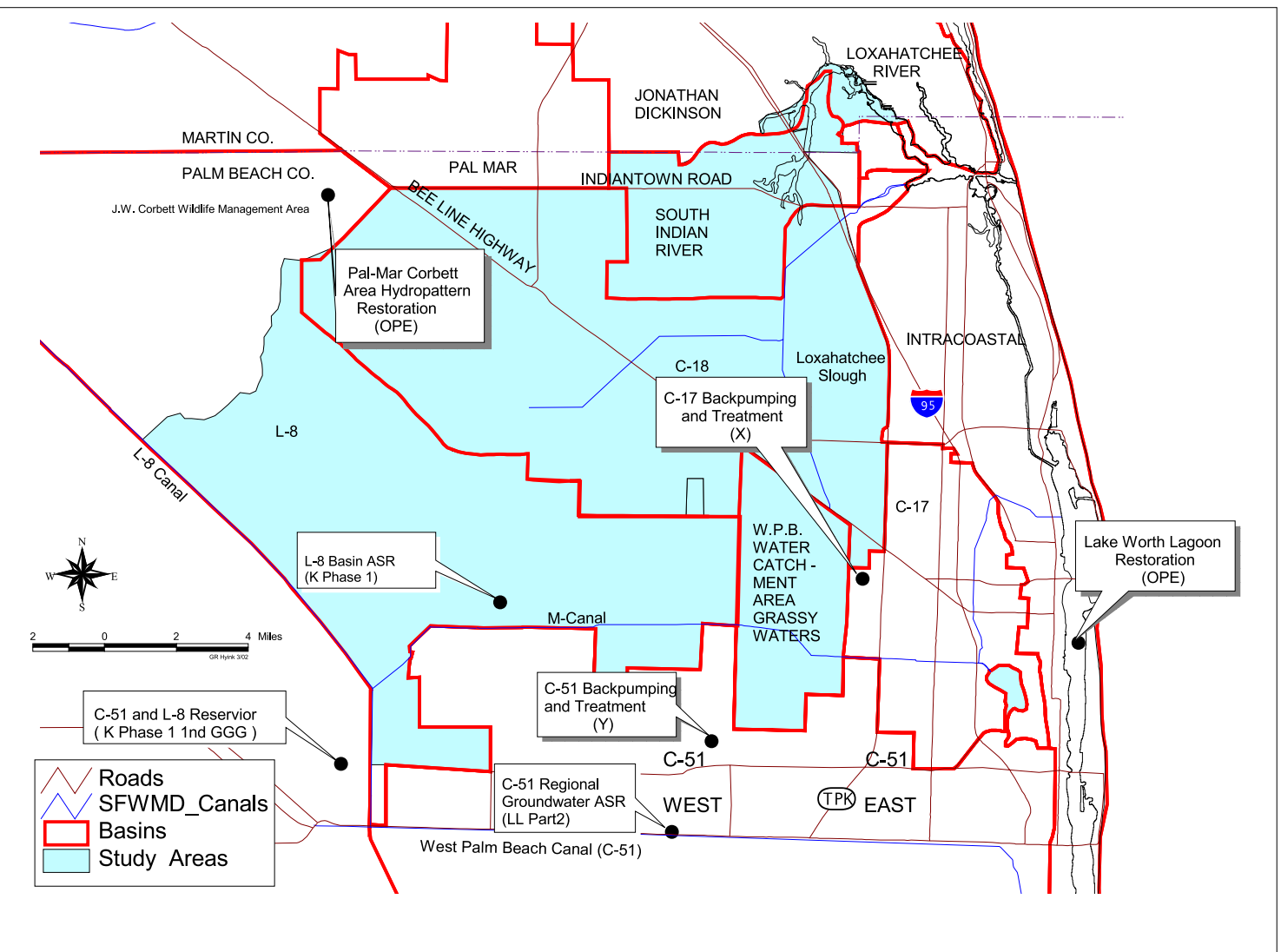


Figure 3. Approximate Locations of Comprehensive Everglades Restoration Plan (CERP) Components (K, Y, X, LL, and GGG) and Other Project Elements.

Park. This project element is scheduled to begin in September 2003 and be completed by March 2009.

L-8 Basin Modifications (K - Phase 1)

This separable element involves modifications to the L-8 Basin including a series of pumps, water control structures, and canal capacity improvements in the M-Canal. The purpose of this project is to construct the required conveyance to make the C-51 and L-8 Reservoir functional and thereby increase water supply availability while maintaining or enhancing flood protection for northern Palm Beach County areas. This component will also provide conveyances necessary to deliver flows required to enhance hydroperiods in the Loxahatchee Slough, increase baseflows to the Northwest Fork of the Loxahatchee River, and reduce high discharges to the Lake Worth Lagoon.

C-51 and Southern L-8 Reservoir (GGG)

This separable element includes a reservoir with a combined above-ground and in-ground storage capacity of approximately 48,000 acre-feet that is located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County. The initial design assumed a 1,800-acre reservoir with 1,200 usable acres with the water level fluctuating from 10 feet above grade to 30 feet below grade. The final size, depth, and configuration of this facility will be determined through more detailed planning and design.

The purpose of this element is to increase water supply availability, and attenuate discharge to the Lake Worth Lagoon and provide compatible drainage benefits for northern Palm Beach County areas. It will also provide flows to enhance hydroperiods in the Loxahatchee Slough, increase baseflows to the Northwest Fork of the Loxahatchee River, and reduce high discharges to the Lake Worth Lagoon.

Water will be pumped into the reservoir from the C-51 Canal and Southern L-8 Borrow Canal during the wet season, or periods when excess water is available, and returned to the C-51 and L-8 during dry periods. Additional projects will also direct excess water into the City of West Palm Beach Grassy Waters Preserve. This component or portions of this component may be implemented under a previous authorization. This component is scheduled to begin in March 2004 and be completed by September 2024.

Lake Worth Lagoon Restoration (OPE)

This element includes sediment removal in the C-51 Canal and sediment removal or capping within a distance of 2.5 miles downstream of the confluence of the C-51 Canal and Lake Worth Lagoon. A prototype project will be conducted to determine the feasibility and potential cost of removing and disposing of sediments in the lagoon versus capping them. This project includes the evaluation of sediment traps to reduce future accumulation of sediment.

The purpose of this element is to improve water quality and allow for the reestablishment of sea grasses and benthic communities. The elimination of the organically enriched sediment from the C-51 Canal discharge will provide for long-term improvements to the lagoon and enable success for additional habitat restoration and enhancement projects planned by Palm Beach County. This component is scheduled to begin in March 2004 and be completed by March 2008.

C-17 Backpumping and Treatment (X)

This element includes backpumping facilities and a STA with a total storage capacity of approximately 2,200 acre-feet located in northeastern Palm Beach County. The design assumes a 550-acre STA with the water level fluctuating up to 4 feet above grade. The final size, depth and configuration of this facility will be determined through more detailed planning and design, and will address appropriate pollution load reduction targets necessary to protect receiving waters (e.g., the City of West Palm Beach Grassy Waters Preserve).

The purpose of this element is to increase water supplies to the Grassy Waters Preserve and Loxahatchee Slough by capturing and storing excess flows currently discharged to the Lake Worth Lagoon from the C-17 Canal. Excess C-17 Canal water will be backpumped through existing canals and proposed water control structures to the STA which will provide water quality treatment prior to discharge into the Grassy Waters Preserve. This component is scheduled to begin in September 2003 and be completed by March 2010.

C-51 Backpumping and Treatment (Y)

This element includes backpumping facilities and a stormwater treatment area (STA) with a total storage capacity of approximately 2,400 acre-feet located in Palm Beach County. The design includes a 600-acre STA with the water level fluctuating up to 4 feet above grade. The final size, depth and configuration of this facility will be determined through more detailed planning and design, and will address appropriate pollution load reduction targets necessary to protect receiving waters (e.g., the West Palm Beach Grassy Waters Preserve). The purpose of this project is to increase water supplies to the Grassy Waters Preserve and Loxahatchee Slough by capturing and storing excess flows currently discharged to the Lake Worth Lagoon from the C-51 Canal. The conceptual design allows excess C-51 Canal water to be backpumped through existing and proposed water control structures and canals to the STA. The STA will provide water quality treatment prior to discharge into the Grassy Waters Preserve.

North Palm Beach County Project Implementation Report (PIR) - Part 2

C-51 Regional Groundwater Aquifer Storage and Recovery (LL)

This element includes a series of ASR wells with a total capacity of 170 mgd, associated pre- and post- water quality treatment to be constructed along the C-51 Canal, and canals that can receive water from the C-51 Canal. The conceptual design assumes 34 well clusters, each with an individual capacity of 5 mgd, fed by a combination of vertical and horizontal wells located near existing canals. The conceptual design includes disinfection pretreatment and post storage aeration. The level and extent of treatment and number of the ASR wells may be modified based on findings from a proposed ASR pilot project.

The purpose of this element is to capture and store excess flows from the C-51 Canal, currently discharged to the Lake Worth Lagoon, for later use during dry periods. The ASR facilities will be used to inject and store surficial aquifer ground water adjacent to the C-51 Canal into the upper Floridan aquifer instead of discharging the canal water to tide. Water will be returned to the C-51 Canal to help maintain canal stages during the dry-season. If water is not available in the ASR system, existing rules for water delivery to this region will be applied. This component is scheduled to begin in March 2011 and be completed by March 2020.

L-8 Basin Aquifer Storage and Recovery (ASR) (K - Phase 2)

The L-8 Basin ASR element will increase water availability and improve drainage for northern Palm Beach County by adding long-term storage in a 50 mgd well system. This component will provide water storage capacity that can be used to enhance hydroperiods in the Loxahatchee Slough, increase baseflows to the Northwest Fork of the Loxahatchee River, meet urban water demands and reduce annual discharges to the Lake Worth Lagoon.

During periods when the Grassy Waters Preserve is above desired stages, up to 50 mgd will be stored in the Floridan aquifer using ASR wells. The initial design of the ASR wells assumed that ten wells would be constructed and that each well would have a capacity of 5 mgd. The source of water for the ASR system is ground water supplied from a combination of vertical and horizontal wells in the Surficial Aquifer System (SAS). The ASR systems include disinfection pretreatment and postwithdrawal aeration. The level and extent of treatment and number of the ASR wells may be modified based on findings from a proposed ASR pilot project and based on local conditions encountered during development of the PIR for Part 2. The operation of the L-8 Basin ASR system will be synergistic with the proposed reservoir and conveyance improvements that are identified in the CERP North Palm Beach County Project. This component is scheduled to begin in March 2011 and be completed by December 2017.

Other Federal Projects in Northern Palm Beach County

Other federal (non-CERP) projects within the planning area that have federal funding or support are discussed, including L-8 General Re-evaluation Report (GRR) Phases 1-4, the S-155A Structure, and Regional Reuse of Reclaimed Water.

LOCAL OPTION PROJECTS

The eight projects listed below were identified by the northern Palm Beach County TAC and PAC as activities that could potentially enhance the ability to effectively manage regional water resources. General locations of these projects are shown in **Figure 4**.

The following section provides brief descriptions of the features of eight local option projects. A table at the end of the section summarizes overall costs and key participants for seven of these projects, to the extent that these are presently determined. The status of the eighth project, the C-18 Reservoir, is uncertain (see discussion below) and hence was not included in the table. The potential usefulness of these projects was assessed through the use of hydrologic simulation models. In some cases these projects provide improvements that address existing problems. In other cases they enhance the ability to realize local benefits from regional projects that are being constructed through the CERP. In many ways, these projects form the core of the NPBCCWMP that will require considerable local support and commitment to be completed.

L-8 Pilot Water Storage Project

The Pilot Water Storage Project is a separate but related project to the L-8 General Re-evaluation Report project that is discussed in the “Related Projects” section of this document. This project is currently underway and addresses geophysical and environmental questions about the use of abandoned rock mining pits, located near the junction of the L-8 and C-51 canals, as a reservoir. An area of 1,200 acres may be available. With an estimated operating depth of 40 feet, this reservoir has a potential capacity of 48,000 acre-feet.

Using a 100-acre pit excavated to approximately 35 feet below land surface, the pilot project will help to determine whether a subterranean seepage barrier will be needed around the perimeter of the reservoir to prevent the inflow of connate groundwater with elevated chloride levels from seeping into the reservoir. Local partners in the study include Indian Trail Improvement District (ITID), Palm Beach County, and the City of West Palm Beach. The data from the pilot project will be used in both the L-8 GRR and Northern Palm Beach County PIR. Work on the pilot project is being performed by a consultant. With guidance from the local partners. The scope of work for the pilot project is contained in a consent agreement between the SFWMD and ITID.

The Pilot Water Storage Project is being funded at a cost of \$440,000. The SFWMD will pay approximately 75 percent of the cost. This project is expected to conclude early in 2002. In addition, the local partners have received initial funding for the

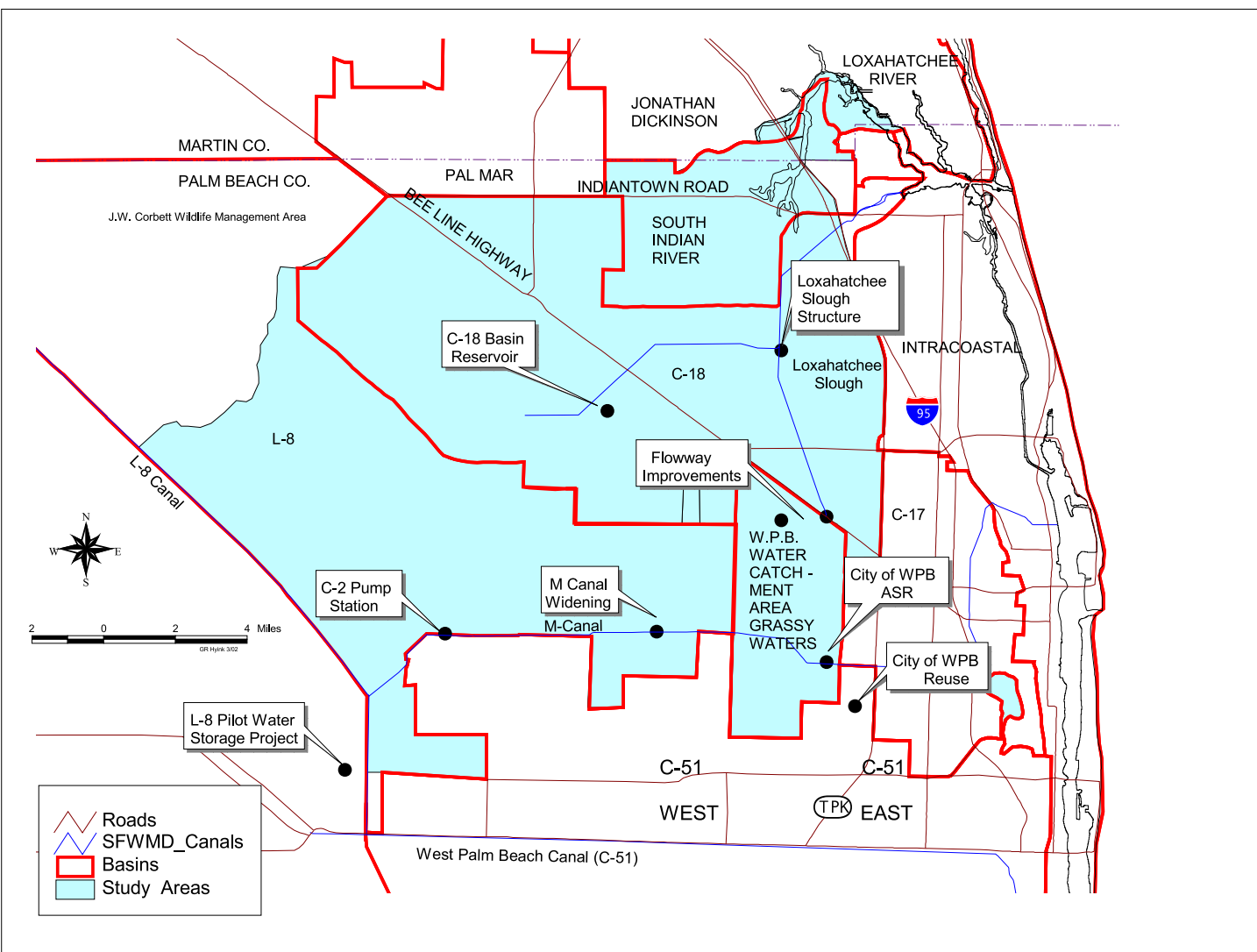


Figure 4. Local Option Projects Discussed in This Plan.

L-8 Reservoir Testing Project (see below) to determine operational parameters for the reservoir.

If this pilot project concludes that the rock mining pits will not require seepage barriers, and no significant impacts are likely to occur from ground water chloride levels, the next step will be to proceed with the L-8 Reservoir Testing Project.

L-8 Reservoir Testing

In conjunction with development of the PIR for Phase I CERP components, authorization was given to move forward with the L-8 Reservoir Testing Project, using local and state funds. This project is designed as a follow-up to the L-8 Pilot Water Storage Project to determine how a reservoir at this location would actually perform during operation. This three-year study will use two existing rockpits and evaluate the ability to move water into and out of these facilities to meet water supply and flood control requirements. The quality of water in the pits and adjacent areas will also be monitored to determine the ability to meet Class I and Class III water quality standards. Subsequently, when the L-8 Basin component is initiated, these funds will be credited as a matching contribution to the CERP project. The total (local and federal) cost of the reservoir testing project is not to exceed \$3,100,000.

M-Canal Widening

The City of West Palm Beach has begun a project to expand the conveyance capacity of the M-Canal to 450 cfs. The current estimate of total project cost is approximately \$3,000,000 and the project is scheduled for completion in 2005. The City of West Palm Beach budgeted \$562,000 in 2000 to begin this multiyear project and also received a grant from the United States Environmental Protection Agency/Veteran's Administration - Department of Housing and Urban Development (USEPA/VA - HUD) in the amount of \$1,412,000. The SFWMD provided cooperative funding via state appropriations of \$750,000 during Fiscal Year (FY) 2000. Under the terms of an interlocal agreement that was approved in October 2001, ITID will provide \$200,000 to reimburse the City of West Palm Beach for a portion of the \$500,000 initial local cost. The City of West Palm Beach anticipates that the sale of fill material will reduce the overall construction costs. As mitigation for the environmental impacts associated with this project, the City of West Palm Beach is required to make conveyance improvements within and adjacent to the Grassy Waters Preserve that will provide additional flow capacity into the Loxahatchee Slough. For purposes of the Phase 2 modeling in the L-8 GRR, an assumption is made that the M-Canal widening will be completed on schedule and will not be subject to evaluation as an alternative in that process.

Control 2 Pump Station

A verbal agreement exists between the City of West Palm Beach, ITID, and SFWMD to build a new pump station of 400 cubic feet per second (cfs) capacity at the western end of the M-Canal. This new pump station will allow more water to be

pumped from L-8 Canal into the M-Canal for delivery into the Grassy Waters Preserve. The proposed location of the pump station is the subject of a cooperative agreement among the participants that will be developed in FY 2002. Water quality related to the relocation of this pump is not an issue.

The most recent cost estimate for this project is between \$3,500,000 and \$4,000,000. The SFWMD has made a congressional grant application for \$2,000,000 during FY 2002. If successful, the balance would be the responsibility of the local partners. An immediate priority is to develop a written agreement between the local partners. The first phase, in FY 2002, would consist of a siting study, preliminary design, and permitting at an estimated local cost of \$250,000. Construction is anticipated to occur in two phases, corresponding roughly with FY 2003 and FY 2004. The local portion of construction cost is estimated as \$1,750,000.

City of West Palm Beach Aquifer Storage and Recovery (ASR) Project

The modeling for the NPBCCWMP assumed that ten 5-mgd wells with a total of 5,000 acre-feet of storage capacity were constructed at some location near or within Grassy Waters Preserve. The wells would inject or withdraw water depending on the stage in the preserve. Under the evaluated scenario, injection would occur at a stage of 18.0 feet NGVD in the wet season and 18.2 feet NGVD in the dry season. Withdrawal would occur when water levels in the preserve reached a stage of 17.9 feet NGVD for both the wet and dry season.

In FY 2001, the City of West Palm Beach and SFWMD shared the cost of the siting study, using local funds and proceeds from an Alternative Water Supply Grant to determine desirable locations for the 50 mgd capacity ASR facilities in the vicinity of the Grassy Waters Preserve, M-Canal, and C-18 Basin. Once the siting study is complete, a pilot study to construct one 5-mgd test well will begin, which is estimated to cost \$2,200,000. The anticipated cost of the completed wellfield is approximately \$12,000,000 to \$15,000,000. Where applicable, funding agreements between the City of West Palm Beach and the SFWMD will be finalized at the conclusion of the siting study.

City of West Palm Beach's Wetlands-Based Water Reclamation Project

The City of West Palm Beach's Phase 1 Wetlands-Based Water Reclamation Project calls for the development of a 10 mgd reuse system. The modeling assumed that advanced-treated reclaimed water could be discharged to nearby wetlands to provide recharge, pumped from groundwater, and indirectly routed into the Grassy Waters Preserve until water levels in the preserve reached a dry season threshold of 18.2 feet NGVD. The City is currently constructing this Wetlands-Based Water Reclamation Project and anticipates completion in the summer of 2003.

Since the analyses for this plan were completed, additional demands for reclaimed water have been identified and are being addressed as part of an ongoing Northern Palm Beach County Reuse Project Master Plan Study. This effort is listed in this plan because it is currently underway and has obvious benefits to the region, even though these benefits were not incorporated into the modeling process. The Northern Palm Beach County Reuse Project Master Plan Study is discussed in the "Related Projects" section. The full project will transport reclaimed water (10-15 mgd) from the East Central Regional Wastewater Treatment Facility (Palm Beach County Utilities, Lake Worth, Palm Beach, Riviera Beach, West Palm Beach) northward to meet the growing needs of communities in northern Palm Beach and southern Martin counties, including Jupiter and Jupiter Island and possibly Palm Beach Gardens and Tequesta. The study will be completed in 2002. Funding for the full project will involve cost-sharing among the utilities, local governments, and the SFWMD.

Flowway Improvements from Grassy Waters Preserve to Loxahatchee Slough (G-161 Structure)

The benefits to the Loxahatchee Slough and the Northwest Fork of the Loxahatchee River from creating an interim conveyance of up to 44 cfs are discussed previously (see "Solution Development" section) and in the Technical Support Document. However, an additional flow above this quantity for the protection of the slough and the river is desirable. The need for a total conveyance capacity of 150 cfs from the regional system (e.g., L-8 Canal) through the Grassy Waters Preserve to the C-18 Basin was determined based on modeling results. A desirable conveyance route for this water was identified to be from the L-8 Canal through the M-Canal to the Loxahatchee Slough portion of the C-18 Basin.

To provide conveyance rates above 44 cfs through this route, improvements to the perimeter canal of the Grassy Waters Preserve, installation of operable gates, stabilizing of existing conveyance channels under the railroad trestle, construction of box culverts under Northlake Boulevard, and creation of a flowway from Northlake Boulevard to C-18 Canal would be required. The Palm Beach County Department of Environmental Resources Management (DERM) has indicated that it would prefer a design that includes a bridge at the junction with Northlake Boulevard, which would facilitate the movement of wildlife and canoeists between the two water bodies. Palm Beach County is taking the lead to design facilities, with in-kind contributions from the SFWMD. Agreement exists to go forward with an interim plan to take advantage of the 44 cfs of gravity flow:

- By June 2003, the City of West Palm Beach will make maintenance improvements in the canal that parallels Northlake Boulevard on the south side and install three 72-inch diameter culverts with a 50 cfs capacity underneath the entrance to the nature center on the south side of Northlake Boulevard. An engineering evaluation of the necessity of the City's C-5 Structure will be completed to determine its function in the overall design. In this same period, the SFWMD will conduct surveys to determine the preliminary design of the flowway

improvements for G-161 between the Grassy Waters Preserve and the Loxahatchee Slough. The overall design phase will be concluded.

- By 2007, the C-2 Pump Station will be constructed, allowing the Grassy Waters Preserve to receive a total of 400 cfs from the regional system for distribution to the Northern Palm Beach County Planning Area. This includes up to 150 cfs to help meet hydroperiod targets in the Loxahatchee Slough and MFL deliveries to the Loxahatchee River. If included in the final design, the box culverts under Northlake Boulevard (the G-161 Structure) will be constructed.

The current estimate for this aspect of the project is \$1,200,000, if it is included in the final design. Cost estimates are currently under development for other project features. The participating agencies will develop Memorandums of Understanding (MOUs) concerning maintenance and operation responsibilities and operational protocols for the new facilities.

Loxahatchee Slough (G-160) Structure

As modeled, the proposed G-160 Structure will have two remotely operated gates. Accurate discharges in the 0-100 cfs range will be possible, as well as larger discharges. The design discharge capacity for a 1-in-100 year storm event will be 1,100 cfs. This structure will serve to impound water at stages and durations necessary to achieve hydroperiod restoration targets in the Loxahatchee Slough. The slough will also serve as a source of water to provide baseflows to the Northwest Fork of the Loxahatchee River when the stage in the slough is above the hydroperiod target.

Operation will be guided by modeling results that indicate that a viable rainfall driven hydroperiod can be achieved in the slough during a normal rainfall year. Recent field measurements in the Loxahatchee Slough, west of the C-18 Canal, indicate that local rainfall in a normal year is sufficient to fill the slough to 17.0 feet NGVD. This stage declines slowly to a minimum of 15.4 feet NGVD, primarily by evaporation and secondarily by seepage losses. The resulting end of dry season stage is just slightly below the target hydrograph stage of 15.5 feet NGVD. The slough is completely dry (except for the C-18 Canal) when the water level is below 15.0 feet NGVD.

With the current drainage area and control constraints, little or no water can be released through the proposed structure in years with average rainfall without reducing the slough's hydroperiod. However, the redirection of water from the adjacent (west) Sandhill Tract will provide additional water. The South Indian River Water Control District (SIRWCD), including Jupiter Farms, is a primary source of water to the Northwest Fork of the Loxahatchee River. If discharge from SIRWCD is insufficient, water is imported from the C-18 Basin through the G-92 Structure. When water levels in the slough are above the target hydroperiod water can be released to supplement the baseflow requirement to the Northwest Fork of the Loxahatchee River. Modeling indicates that if the slough were full

at the start of the dry season, (e.g., 17.5 feet NGVD), approximately 2,500 acre-feet would be available for release to the river. Since this quantity alone is insufficient to meet downstream demands, a number of supplemental sources are planned. If C-18 Basin water is insufficient to meet the needs of the Northwest Fork of the Loxahatchee River then water may be imported from the Grassy Waters Preserve when hydraulic capacity is available.

Based on a recent agreement, a large development project (Taylor Woodrow Communities at Mirasol, Ltd.) near the slough will provide \$1,000,000 towards cost of G-160. The basis for the agreement is a SFWMD Environmental Resources Permit requirement to mitigate on-site wetland impacts resulting from the development. Palm Beach County is a party to the funding agreement. Permitting, construction, and operation of G-160 will be managed by the SFWMD. State and federal permit applications were submitted in early March 2001 and the goal is to complete construction on or before December 1, 2006.

C-18 Reservoir

The option of creating a distributed storage system was considered in the planning analysis. The majority of the demands and the resulting need for storage are associated with the L-8 Basin and with flow to the Grassy Waters Preserve (which includes water passed through to the City of West Palm Beach's water treatment plant). Two reservoir sizes were modeled. The first reservoir size was small and reflected the fact that at the time of formulation of the plan (1997) there were no willing sellers of large (>200 acre) parcels within the C-18 Basin. The NPBCCWMP Policy Advisory Committee (PAC) and Technical Advisory Committee (TAC) decided to perform only limited assessments of reservoirs as result of the lack of willing sellers. This reservoir was modeled with a footprint of 300 acres. No specific site for the conceptual reservoir was identified, and the size was based on the assumption that no tract of land larger than 300 acres was available in the basin. A rate of 300 cfs was assumed for pumping into, and discharge out of, the reservoir. The effective storage depth was determined to be 6 feet for a total available storage volume of 1,800 acre-feet. This reservoir did provide some minor benefits by storing wet season water for use during the dry season, but was inadequate to provide water at the end of the dry season or during a drought. For example, if 50 cfs (100 acre-feet per day) of supplemental water were needed to maintain salt water downstream of Kitching Creek then, even when full, this reservoir would provide only 18 days of supply.

The second reservoir was sized to meet the normal dry season needs without concern for land acquisition. A storage volume of 6,000 acre-feet was identified. To prevent excessive evaporation losses, the reservoir was assumed to have a storage depth of at least 6 feet. This size reservoir was effective in storing wet season runoff for use during normal dry seasons but was insufficient to meet local needs during a drought with a 1-in-10 year return period. A considerable benefit of a reservoir within the C-18 Basin would be the ability to capture the high quality wet season discharges from the J.W. Corbett Wildlife Management Area for subsequent use.

A distributed storage system has an advantage in terms of operational flexibility; however, trade-offs are involved. For example, economies of scale can negatively affect land assemblage and construction costs. In the case of the C-18 Reservoir, the availability of large tracts of land is a limiting factor. Although potential benefits of this option were identified, due to the lack of specific size, siting, and costs, implementation of this option is not recommended at this time. A C-18 Reservoir may also be included in the final CERP reservoir configuration.

Summary of Local Option Project Costs, Schedules, and Partners.

Table 4 indicates the proposed implementation of the local option projects discussed above, including estimated total costs, local costs, start and end dates, and potential partners. Because the SFWMD will be assuming responsibility for half of the local costs of these projects, the SFWMD will ensure that water supply benefits to downstream users are protected through operating agreements on key water management structures.

IMPLEMENTATION THROUGH REGULATION AND PERMITTING

Conveyance to Improve Recharge within the Town of Jupiter

Ground water modeling conducted in association with the LECRWSP identified an area of potential saltwater intrusion at Jupiter's existing surficial wellfield. Impounding additional surface water and an increase in the head differential above this area can provide better protection for the wellfield. A process to explore such alternatives is recommended.

South Indian River Water Control District (SIRWCD)

The SIRWCD is a considerable source of water to the Northwest Fork of the Loxahatchee River. The modeling assumed that the lateral control levels described in the Joint Application by FDEP and the SFWMD titled *Loxahatchee River Restoration Plan* (dated February 1984) will be implemented through the installation of operable control structures. The operable control structures will maintain the desired minimum levels in the canals and will open when discharges are necessary. Specifically, SIRWCD Lateral Controls LCS-2 through LCS-6 start to discharge at 12.5 feet NGVD. LCS-2 is located slightly west of 105th Avenue along Canal Number 7. The discharge from SIRWCD to the C-14 Canal will be controlled by the discharge capacity of the Lainhart Dam and the storage available in the SIRWCD. If SIRWCD's discharge to the Northwest Fork of the Loxahatchee River is insufficient, water is imported from the C-18 Basin through the G-92 Structure.

Table 4. Northern Palm Beach County Comprehensive Water Management Plan Projected Funding by Project.

Project	Year Initiated	Estimated Cost (\$ Millions)				Year Comp	Partners (b)
		Total	Local (a)	FY 02	FY 03-05		
L-8 Pilot Water Storage	2000	\$.44 (c)	\$.44	N/A (d)	N/A	2002	PBC, WPB, ITID, SFWMD
L-8 Reservoir Testing Project	2002	\$3.1	\$2.1	\$2.1	TBD		PBC, SFWMD, USACE
L-8 Pump Station (C-2) Diversion siting study	2001	4	2	\$0.5	3.5	2005	WPB, ITID, SFWMD
M-Canal Widening	2000	\$3	\$1.6	\$0.7	1.4	2005	WPB, SFWMD , ITID
ASR Wellfield Feasibility and Pilot	2001	\$2.27 (e)	\$1.17	\$0.4	\$1.8	2004	WPB, SFWMD
WPB Wetland Reclamation Phases 1 & 2	2000	\$21.4	\$12.6	\$8.8	N/A	2003	WPB, SFWMD USEPA
G-161 and Flowway Improvements	2001	\$1.2 (h)	\$1.2	--	\$1.2	2004	PBC, WPB, SFWMD
3-72 inch Culverts	2001	0.1	0.1	0.1	N/A	2003	
G-160 Loxahatchee Slough Structure	2000	\$2.5	N/A	(g)	(g)	2006	PBC, SFWMD, Private
Total		\$38.01	\$21.21	\$14.20	\$7.74		

Notes: (a) Local costs are assumed to be the nonfederal funded portions of total costs, including combined SFWMD, local and other government contributions. Local costs are assumed to be 50 percent of total project costs for general planning purposes; (b) PBC = Palm Beach County, WPB = City of West Palm Beach, ITID = Indian Trails Improvement District, ECR = East Coast Regional Water Utility, Jupiter = Town of Jupiter Water Utility, ENCON = Loxahatchee River Environmental Control District, USEPA = United States Environmental Protection Agency, USACE = United States Army Corps of Engineers; (c) Pilot project to collect geophysical data separate from L-8 GRR Phase 1 (see Table 5); (d) Further testing and engineering design absorbed into "Reservoir Testing Project" under CERP; (e) Feasibility study and siting of one 5 mgd pilot well only; (f) CERP anticipates a (10)-5 mgd ASR wellfield; (g) Construction administration costs only (h) cost may be higher if a bridge is used.

Mirasol

The rerouting of the Old Marsh discharge is necessary to facilitate the storage of water above 17.0 feet NGVD in the portion of the Loxahatchee Slough east of the C-18 Canal. This and other improvements will be constructed as part of the Mirasol (formerly known as Golf Digest) project, located on PGA Boulevard west of the Florida Turnpike in Palm Beach Gardens, and are discussed in their operational plan (SFWMD, 2000). The following information provides a summary of the predevelopment and postdevelopment water management and water conservation/budget aspects of this project to facilitate a better understanding and description of its effects on water management, water supply, and environmental resources.

Predevelopment Conditions

The original Loxahatchee Slough and Loxahatchee River system has been altered by numerous facilities constructed by man. The primary slough component is the C-18 Canal that was built by the USACE during the late 1950's. This canal, which is presently maintained at 14.8 feet NGVD, drains the slough and directs water to the Southwest Fork of the Loxahatchee River via the S-46 Spillway Structure and to the Northwest Fork via the G-92 Control Structure.

The predevelopment Mirasol site contained numerous ditches with one primary ditch connected to the Florida Turnpike borrow canals and the Florida Turnpike Interchange at PGA Boulevard. This primary east-west ditch connects into the existing outfall canal from the Old Marsh and Eastpointe projects (located along the perimeter of the eastern portion of the Loxahatchee Slough), which continues down to an overflow point into the C-18 Canal. The primary canal is relatively deep (> 5 feet) allowing water to be conveyed when the C-18 Canal stage is below the ground surface (~15.5 feet NGVD). The point of connection contains a set of USACE project culverts with risers that have been left open such that the upstream canal and ditch system have water levels fluctuating at the same levels as those within the C-18 Canal. Historically, it has been documented that this open connection allows water from the C-18 Canal to backflow into the Mirasol site ditch system, thus providing recharge to the Seacoast Utility Authority Hood Road Wellfield, which is located just east of the property. This original backflow of recharge water was documented to be up to 1.0 mgd as part of the SFWMD Water Use Permit issued to Seacoast Utility Authority for the Hood Road Wellfield. Further analysis of the existing drainage system as part of the permitting of the Mirasol project indicated that the quantity of recharge water that backflowed from the C-18 Canal was as high as 6.8 mgd. This high rate is believed to be due to water backflowing into the eastern portion of the slough to refill wetland areas inadvertently drained when the S-46 Structure is opened.

Water Management Plan

The primary benefit associated with construction of the water management system for the Mirasol site is the ability to manage and control water entering and leaving the site where previously it was uncontrolled. Flows from the Old Marsh and Eastpointe projects can now be redirected into the Mirasol water management system for additional storage, water quality treatment, on-site wetland hydroperiod improvements, and ultimate discharge (overflow) into Loxahatchee Slough, as opposed to discharging directly to the C-18 Canal. Overflow from the Mirasol site will be directed to the eastern portion of Loxahatchee Slough via a spreader swale, to help maintain/restore hydroperiods in the slough.

Onsite water levels are now maintained at higher elevations than could be maintained previously. The eastern portion is controlled at 16.8 feet NGVD and the smaller western portion controlled at 15.0 feet NGVD. The water budget model prepared for the site indicates a 23 percent reduction in annual flows off-site, compared to predevelopment conditions. The project improves the ability to restore the eastern portion

of the slough because a berm has been constructed on the west and north sides of the Old Marsh outfall canal that prevents draining of the slough.

The water management system under construction will allow (by gravity) an annual average inflow from C-18 Canal of 1.3 mgd, rather than the 2.7 mgd average flow that occurred historically, to recharge the Hood Road Wellfield. Under the gravity recharge system, the 6.8 mgd maximum monthly inflow from the C-18 Canal is reduced to 3.3 mgd and is cut off entirely when canal stages drop below 14.0 feet NGVD (before construction of G-160). Seepage losses from the Eastpointe project are reduced by 69 percent and on-site aquifer recharge is increased by 83 percent. In addition, the two proposed golf courses will be irrigated using 1.3 mgd of reclaimed water from Seacoast Utility Authority. The water management system provides detention for the first 1.5 inches of stormwater runoff for water quality treatment purposes in accordance with Outstanding Florida Waters Rule requirements. An additional 1.5 foot of storage is provided in the west basin for dry season storage and transfer to the east basin in dry times.

The project provides one million dollars towards construction of the new C-18 Water Control Structure (G-160) that will restore wetland hydroperiods within the slough to nearly historic levels. Reflooding of the slough will be possible because of design features in the Mirasol project to protect adjacent property from flooding, by the following:

- Redirecting flows from the Old Marsh and Eastpointe projects
- Eliminating the gravity flow from the Old Marsh outfall canal
- Construction of berms to protect Mirasol properties

In addition, increased water retention on the property, more efficient management of lakes and wetlands, and the inflow of 1.3 mgd of reclaimed water that will be used for irrigation, means that this area is less reliant on flow from the C-18 Canal to provide onsite irrigation water and recharge to adjacent wellfields. Due to the improvements provided by the Mirasol project, Seacoast Utility Authority was issued a new permit that allows pumpage from Hood Road Wellfield to be increased from an annual average of 10.4 mgd up to 13.6 mgd, while decreasing the amount of flow needed from C-18 Canal from an annual average daily flow of 2.7 mgd down to 1.3 mgd.